Province of the EASTERN CAPE EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 12

JUNE 2023

MATHEMATICS P1 (DEAF)

MARKS: 150

TIME: 3 hours

This question has **9 pages** and **1 information sheet**.

INSTRUCTIONS AND INFORMATION

Read the instructions.

1. This **question paper** has of **10 questions**.

2. **Answer ALL** the questions.

3. **Number** the **answers** the **same** as the numbers on the **question paper**.

4. Clearly **show ALL calculations**, **diagrams**, **graphs** that you used in your answers.

5. You will **NOT** always **get marks** for **answer only**.

6. You **may use** a prescribed **calculator**.
   Some questions will tell you **NOT** to **use a calculator**.

7. **Round off** answers to **TWO decimal places**.
   Some questions will **tell** you **how** to **round off**.

8. **Diagrams** are **NOT** drawn to **scale**.
   Some questions will **tell** you to **use the scale**.

9. An **information sheet** with **formulae** is at the **end** of the question paper.

10. Write **neatly**.

QUESTION 1

1.1 **Solve** for x:

1.1.1 $x^2 - 9 = 0$ (2)

1.1.2 $x - 5 + \frac{2}{x} = 0$ (correct to **TWO decimal places**) (4)

1.1.3 $x = 1 + \sqrt{7 - x}$ (5)

1.1.4 $x^2 + 2x - 15 \geq 0$ (3)

1.2 Solve for x **and** y simultaneously(at the same time) :

$$y + 2x = 3$$
$$y^2 - y = 3x^2 - 5x$$
(6)

1.3 Do **NOT use** a **calculator**:
Simplify completely.

$$\sqrt[n]{\frac{10^n + 2^{n+2}}{5^{2n} + 4\left(5^n\right)}}$$
(4)
[24]

QUESTION 2

2.1 **Given** the **geometric series**: $\frac{24}{x} + 12 + 6x + 3x^2 + \ldots$

2.1.1 **Determine** the value of r, the common ratio, in terms of x. (1)

2.1.2 **Determine** the values of x for which this series converges. (2)

2.1.3 If $x = 4$, **determine** the **sum** of the **series** to 15 terms. (3)

2.2 **Calculat**e: $\sum_{n=1}^{\infty} 6(2)^{-n}$ (3)

2.3 The **sum** of the **first** *n* **terms** of an **arithmetic series is** given by $S_n = -n^2 + 8n$.

2.3.1 **Calculate** the **sum** of the **first 15 terms**. (2)

2.3.2 **Calculate** the **value** of T_{15} . (2)

2.3.3 If the **first term** of the **series** is **7**, **which term** of the **series** will **have** a **value** of −169? (4)

[17]

QUESTION 3

Consider the **quadratic number pattern**: 95 ; 72 ; y ; 32 ; . . .

3.1 **Determine** the **value** of y. (2)

3.2 If $y = 51$, **determine** the **general term** of the **number pattern in** the form $T_n = an^2 + bn + c$. (4)

3.3 **Determine** T_{22} . (1)

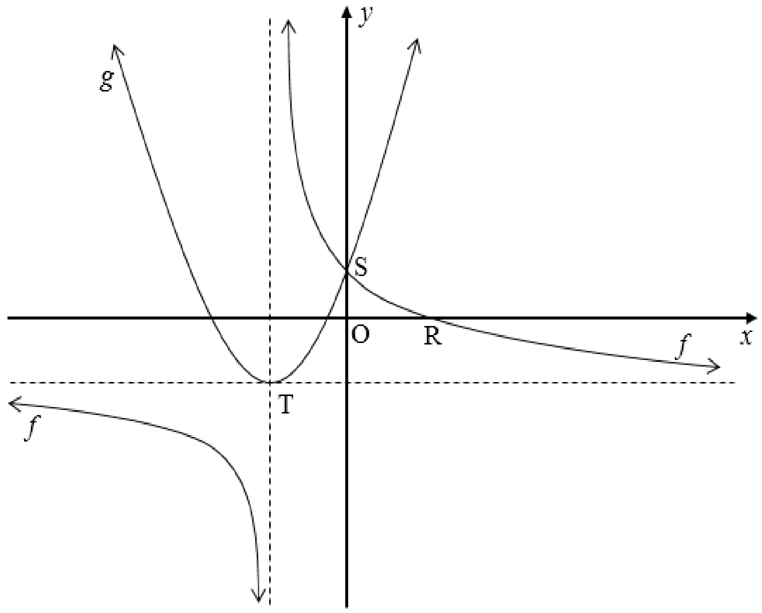
3.4 **Which** term in the **number pattern** will be **equal to** 1 040? (4)

[11]

QUESTION 4

Given: Diagram below shows the **graphs** of $f(x) = \dfrac{5}{x+p} + q$ and $g(x) = 5x^2 + 10x + 3$.

The **two graphs intersect** at S, the *y*-intercept of **both graphs**. R is the *x*-intercept of f.
The **asymptotes** of f cut at T, the **turning point** of *g*.



4.1 **Write** down the **coordinates** of **S**. (2)

4.2 **Determine**:

4.2.1 The **coordinates** of **T** (4)

4.2.2 The **values** of p and q (2)

4.2.3 The **length** of OR (2)

4.2.4 The **range** of g (2)

4.3 **Determine** the **equation** of:

4.3.1 The **tangent** to *g* at S (3)

4.3.2 The **axis** of **symmetry** of f, with a **positive gradient** (2)

4.4 For which **values** of x will $g^{/}(x).\,f(x) \leq 0$? (2)

[19]

QUESTION 5

Given: $h(x) = a^x$; $a > 0$ and $a \neq 1$. $B\left(-1\,;\,\frac{1}{2}\right)$ is a **point** that **lies** on *h*, the **graph** of *h*(*x*).

5.1 **Determine** the **value** of a. (2)

5.2 **Write** the **equation** of h^{-1} in the form *y* = . . . (2)

5.3 **Sketch** the **graphs** of h and h^{-1} on the **same set** of **axes**. **Show** all **intercepts** with the **axes**. (4)

5.4 **Write** the **domain** of h^{-1}. (1)

5.5 **Determine** the **value(s)** of x for which $h^{-1}(x) > 1$. (1)

5.6 If it is **given** that $t(x) = \left(\frac{1}{2}\right)^x - 1$.

5.6.1 **Describe** the **transformation** from h to t. (2)

5.6.2 **Determine** the **equation** of the **asymptote** of t. (1)

[13]

QUESTION 6

6.1 A **school bought computers** for R980 000. The **value** of the **computers depreciates(reduces) annually(yearly)** at a **rate** of 9,2% p.a. on the **reducing-balance** method. **Calculate** the **book value** of the computers after 7 years. (3)

6.2 Siphokazi **invests** R13 500 for a certain **number of years**. She **earns interest** at a **rate** of 8,2% per annum, **compounded(combined)** annually. The **final value** of the **investment** is worth R20 020,28.
For **how many years** was the **money invested**? (4)

6.3 On 1 January 2017 Nelson **deposited** R3 500 into a savings account. On 1 January 2020, he deposited **another** R5 700 into the **same account**. The **interest rate** for the **first two years** (starting from 1 January 2017) is 7% per **annum(year) compounded(combined)** quarterly, and the interest rate for the last three years is 8% per annum **compounded(combined)** monthly. **Calculate** the **amount** in the **savings account** after **5 years**. (6)

[13]

QUESTION 7

7.1 **Determine** $f^{/}(x)$, from **first principles**, if $f(x)=5-2x^2$. (4)

7.2 **Determine**:

7.2.1 $f^{/}(x)$, if $f(x)=2x^5-7\sqrt{x}+\dfrac{1}{x}$ (4)

7.2.2 $\dfrac{d}{dx}\left[\dfrac{2x^2-x-6}{2x+3}\right]$ (3)

[11]

QUESTION 8

Given: $f\left(x\right)=x^3-5x^2-8x+12$ and $g(x)=ax+q$. A, $B(2;-16)$ and $C(6;0)$ are the **points** of **intersection** of f and g.

8.1 **Determine** the **coordinates** of the **turning points** of f. (4)

8.2 **Determine** the other two ***x*-intercepts** of f. (3)

8.3 **Sketch** the **graph** of f, **indicating turning points** and **intercepts** with the **axes**. (4)

8.4 **Determine** the **values** of a and q. (2)

8.5 **Determine** whether the **graph** is **concave up** or **concave down** at **point B**. (3)

8.6 For **which values** of x, is $f(x)\geq g(x)$? (4)

[20]

QUESTION 9

A large cruise **ship uses fuel** at a **cost** of $4x^2$ rand per hour, where x is the **speed** of the **ship** in *km*/*h*.
Other **operating(running) costs**, including **labour**, **amount** to R1 000 per hour.
[**Hint: distance = speed x time:** $s = vt$]

9.1 **Show** that the **total cost** for a **trip** of 500 km is given by, $C(x) = 2\,000x + \dfrac{500\,000}{x}$. (3)

9.2 At what **speed** should the **ship travel** on this 500 km trip to keep the **total cost** as **low as possible**? (5)
[8]

QUESTION 10

10.1 Events A and B are **mutually exclusive**. It is further given that:
- 3P(B) = P(A)
- P(A or B) = 0,64

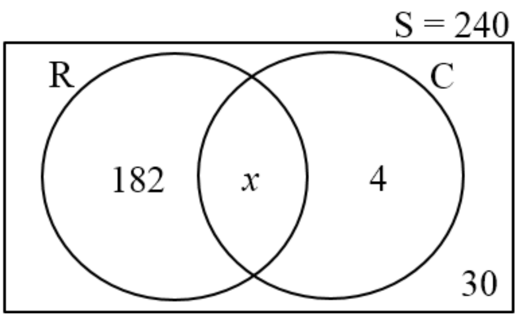
Calculate P(B). (3)

10.2 The **probability** that it will not **rain** on a **given day** is 37%. A child has a 12% chance of **falling** in **dry weather** and is **three times** as likely to **fall** in **wet weather**.

10.2.1 **Draw** a **tree diagram** to represent **ALL** the possible ways in which the **weather** could **affect** whether a **child falls** or not. Show the **probabilities** associated with **EACH branch**, as well as the **outcomes**. (4)

10.2.2 What is the **probability** that a **child** will **not fall** on **any given day**? (2)

10.3 A **group** of **240 learners** were **asked** whether they play Rugby (R) or Cricket (C) as a **school sport**. **206** of the **learners indicated** that they play rugby, 28 said they play cricket, 30 said they play neither and x said they play both. The **information** is **represented** in the **Venn diagram below**.



10.3.1 **Determine** the **value** of x. (2)

10.3.2 Would you **regard** playing rugby and cricket as **independent events**?
Support your **answer** with **calculations**.
(Round answers **correct** to **2 decimal places**.) (3)
[14]

TOTAL: 150

INFORMATION SHEET: MATHEMATICS

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$A = P(1+ni)$ $\quad A = P(1-ni)$ $\quad A = P(1-i)^n$ $\quad A = P(1+i)^n$

$T_n = a + (n-1)d$ $\quad S_n = \frac{n}{2}(2a + (n-1)d)$

$T_n = ar^{n-1}$ $\quad S_n = \frac{a(r^n - 1)}{r-1}$; $r \neq 1$ $\quad S_\infty = \frac{a}{1-r}$; $-1 < r < 1$

$F = \frac{x\left[(1+i)^n - 1\right]}{i}$ $\quad P = \frac{x\left[1-(1+i)^{-n}\right]}{i}$

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $\quad \mathrm{M}\left(\frac{x_1 + x_2}{2}; \frac{y_1 + y_2}{2}\right)$

$y = mx + c$ $\quad y - y_1 = m(x - x_1)$ $\quad m = \frac{y_2 - y_1}{x_2 - x_1}$ $\quad m = \tan\theta$

$(x-a)^2 + (y-b)^2 = r^2$

In ΔABC:

$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ $\quad a^2 = b^2 + c^2 - 2bc.\cos A$ $\quad area\,\Delta ABC = \frac{1}{2}ab.\sin C$

$\sin(\alpha + \beta) = \sin\alpha.\cos\beta + \cos\alpha.\sin\beta$ $\quad \sin(\alpha - \beta) = \sin\alpha.\cos\beta - \cos\alpha.\sin\beta$

$\cos(\alpha + \beta) = \cos\alpha.\cos\beta - \sin\alpha.\sin\beta$ $\quad \cos(\alpha - \beta) = \cos\alpha.\cos\beta + \sin\alpha.\sin\beta$

$\cos 2\alpha = \begin{cases} \cos^2\alpha - \sin^2\alpha \\ 1 - 2\sin^2\alpha \\ 2\cos^2\alpha - 1 \end{cases}$ $\quad \sin 2\alpha = 2\sin\alpha.\cos\alpha$

$\bar{x} = \frac{\sum x}{n}$ $\quad \partial^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n}$ $\quad P(A) = \frac{n(A)}{n(S)}$ $\quad P$ (A or B) = P (A) + P (B) – P (A and B)

$\hat{y} = a + bx$ $\quad b = \frac{\sum(x - \bar{x})(y - \bar{y})}{\sum(x - \bar{x})^2}$